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USACE / NAVFAC / AFCESA **UFGS-L-15802N (MARCH 2001)**

Preparing Activity: LANTNAVFACENGCOM

UNIFIED FACILITIES GUIDE SPECIFICATIONS

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DIVISION 15 - MECHANICAL

SECTION 15802N

FIRE APPARATUS VEHICLE EXHAUST REMOVAL SYSTEM

03/00

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SECTION 15802N

FIRE APPARATUS VEHICLE EXHAUST REMOVAL SYSTEM
03/00

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NOTE: This sample specification is for fire apparatus vehicle exhaust removal system (FAVERS) provided to collect the exhaust emissions from fire and rescue apparatus engines operating within their fire station bays. The FAVERS reduces the exposure of personnel to hazardous diesel engine exhaust products of combustion.

NOTE: Suggestions for improvement of this specification will be welcomed using the Navy "Change Request Forms" subdirectory located in SPECSINTACT in Jobs or Masters under "Forms/Documents" directory or DD Form 1426. Suggestions should be forwarded to:

Commander
Naval Facilities Engineering Command
Engineering Innovation and Criteria Office, Code EICO
1510 Gilbert Street
Norfolk, VA 23511-2699

Email: LantDiv@efdlant.navfac.navy.mil

Use of electronic communication is encouraged.

Brackets are used in the text to indicate designer choices or locations where text must be supplied by the designer.
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NOTE: The following information shall be shown on the project drawings:

1. The designer shall include information on the drawings describing the as-built conditions of the existing facility. Indicate what areas are used presently and cannot be used for the new fire apparatus vehicle exhaust removal system (FAVERS) equipment..

2. The designer shall include information on the drawings describing the vehicles to be exhausted. Include information on vehicle type (ladder, rescue, brush, etc), make and model, engine displacement, fuel type, vehicle length, tailpipe configuration (i.e. passenger side horizontal, passenger type vertical, etc).

3. Arrangement plan and details for design/builder location of fans, ducts, and accessories. Indicate on the drawings the location of the air compressor that is required for the pneumatic grabber nozzle alternative.

4. Equipment Foundations and supports available for fire apparatus vehicle exhaust removal system (FAVERS) equipment.

5. Structural supports for ducts where required.

6. The design of industrial ventilation systems and the editing of this section should be performed by professional engineers or industrial hygienists with a sound knowledge of industrial ventilation. Design should conform to the ACGIH 2092 and the ASHRAE 1999 HVAC Applications Handbook.
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PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS (ACGIH)

ACGIH 2092	(1998) Industrial Ventilation, A Manual of Recommended Practice

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC S335	(1989) Structural Steel Buildings Allowable Stress Design and Plastic Design

AIR MOVEMENT AND CONTROL ASSOCIATION, INC. (AMCA)

AMCA 211	(1987) Certified Ratings Program for Air Moving Devices

AMERICAN SOCIETY OF HEATING, REFRIGERATING, AND AIR-CONDITIONING ENGINEERS, INC. (ASHRAE)

ASHRAE HVAC AH	(1999) HVAC Applications Handbook

AMERICAN WELDING SOCIETY, INC. (AWS)

ANSI/AWS Z49.1	(1994) Safety in Welding, Cutting and Allied Processes

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(1999) National Electrical Code

1.2 SUBMITTALS

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NOTE: Where a "G" in asterisk tokens follows a submittal item, it indicates Government approval for that item. Add "G" in asterisk tokens following any added or existing submittal items deemed sufficiently critical, complex, or aesthetically significant to merit approval by the Government. Submittal items not designated with a "G" will be approved by the QC organization.
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Submit the following in accordance with Section 01330, "Submittal Procedures."

SD-02 Shop Drawings

FAVERS design drawings; G

SD-03 Product Data

Fire apparatus vehicle exhaust removal system (FAVERS); G

SD-06 Test Reports

FAVERS Field Test Report; G

SD-07 Certificates

Manufacturer's letter of installer acceptability; G

FAVERS Field Test Plan; G

SD-10 Operation and Maintenance Data

Fire apparatus vehicle exhaust removal system (FAVERS), Data Package 3

Submit operation and maintenance data in accordance with Section 01781N, "Operation and Maintenance Data."

1.3 FAVERS REQUIRED SEQUENCE OF OPERATION

a. Vehicle returns to the fire station and proceeds to back in or drive through the apparatus bay.

b. With vehicle at the door threshold, [for horizontal exhaust tailpipes, the flexible exhausting hose with exhaust capturing nozzle is attached manually onto the tailpipe of the vehicle]. [For vertical exhaust stacks, the stack end is enveloped by the overhead-rail-mounted extensible hose adapter box or by the suction rail]. The exhaust fan shall then automatically and instantaneously energize.

c. Vehicle can then move to its designated parking position within the apparatus bay.

d. Whenever the engine of the vehicle starts and runs, the FAVERS exhaust fan shall automatically start and run.

e. Upon dispatch of the vehicle, and the vehicle exits the fire station, [for the horizontal exhaust tailpipes, the flexible exhausting hose, mounted to the overhead rail, travels with the vehicle to a predetermined spot where the hose and hose nozzle is automatically released from vehicle tailpipe and is pulled up and out of the way regardless of vehicle speed][and][for the vertical exhaust stacks, the stack end exits the adapter box or suction rail].

f. FAVERS shall automatically be de-energized by an adjustable electronic timer after signal is received that vehicle engine has stopped running or after the vehicle has been dispatched, left the fire station, and FAVERS has been disconnected.

1.4 INDUSTRY STANDARDS RECOMMENDATIONS

The recommendations in the references specified in this section, such as ACGIH 2092, shall be considered mandatory requirements. Substitute the word "shall" for "should" in these manuals.

1.5 RELATED REQUIREMENTS

Section 15050N, "Basic Mechanical Materials and Methods" applies to this section as modified and supplemented by this section.

1.6 SAFETY PRECAUTIONS

1.6.1 Welding

Conform to ANSI/AWS Z49.1 for safety in welding and cutting.

PART 2 PRODUCTS

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NOTE: There are two types of exhaust outlets to be serviced by these systems. The most common type is the horizontal exhaust tailpipe, and the other type is the vertical upward discharge exhaust stack.

The FAVERS vendor-stated advantages of vertical exhaust stacks are that they keep the exhaust fumes away from the fire fighters at all times, on the fire field as well as during maintenance and testing; that they reduce the possibility of choking off the engine when fording streams or working in flooded conditions; and that they reduce the possibility of igniting pools of hydrocarbons that may exist on the fire ground.

Possible disadvantages are that the existing exhaust stacks may have to be modified on all the fire apparatus; that the vertical stacks may also obstruct access to apparatus and equipment; and that modifications may void the apparatus or engine manufacturer's warranty.

The decision to specify systems for vertical discharge stacks must be coordinated with and accepted by the Fire Department personnel and the Public Works Maintenance personnel prior to design.

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2.1 FAVERS DESIGN/BUILD CRITERIA

2.1.1 Unitary System

Provide a fire apparatus vehicle exhaust removal system (FAVERS) design for each [indicated][or specified] vehicle for Contracting Officer approval; and build the approved FAVERS design complete and ready for service. This design shall be compatible with the existing fire station operations and shall not unacceptably interfere the these operations.

This design shall be furnished by FAVERS manufacturer, or by his authorized designer, and shall be developed by engineering the group of interrelated components which have been coordinated and combined by a FAVERS manufacturer into a unitary system. This system shall be indicated in the FAVERS manufacturer's current printed product catalog as a unitary FAVERS system.

2.1.2 Definition - FAVERS Manufacturer

The term "FAVERS manufacturer" is defined as the designer, basic materials acquirer for, machiner of, and assembler of the major FAVERS component;

namely, the exhaust pipe outlet capture device or the stack outlet capture device.

2.1.3 Definition - Printed Product Catalog

The term "FAVERS manufacturer's printed product catalog" as specified in this section is defined as the FAVERS manufacturer's published product data sheets. These data sheets shall have been published or copyrighted prior to the issue date of this solicitation and shall have a document identification number or bulletin number.

2.1.4 FAVERS Designer's Use of Contract Drawings and Specifications

The design and design data indicated on the Government originated contract drawings are the minimum baseline drawing requirements to be used by the FAVERS designer to develop the FAVERS design.

The FAVERS designer shall add to, supplement, and build upon these drawings to fully comply with this specification section. The FAVERS design and design data on the contract drawings shall not be changed unless approved in writing by the Contracting Officer.

For example, the FAVERS designer is responsible for the design of vertical hangers, supports, and diagonal bracing for the FAVERS equipment, including guide tracks. The only source of structural support available for FAVERS manufacturer's hangers, supports, and bracing shall be the fire station's structural systems indicated on the Government originated contract drawings.

Specified hereinafter are the basic interrelated components from which the FAVERS shall be designed and built. Not all of the components specified below are required in the design/build of each FAVERS. The specifications include the basic interrelated components needed to ensure several manufacturers are able to furnish a complete FAVERS design/build from their standard product line as specified above in the paragraph "Unitary System".

If a manufacturer's component is proposed in the submitted FAVERS design which is not listed in the paragraph "FAVERS Components" below, but provides the same function as a listed component, the proposal shall:

a. Comply with the design/build criteria requirements above in the paragraph "Unitary System" and;

b. The proposal shall be submitted for approval by the Contracting Officer as equivalent to the component listed in the paragraph "FAVERS Components" below. This equivalency analysis includes evaluation of elements such as functionality, quality of materials, and durability.

2.1.5 Electrical Design

Comply with NFPA 70.

2.1.6 Ductwork Design

Ductwork comply with ACGIH 2092and ASHRAE HVAC AH for an industrial ventilation system of positive or negative pressure of 8 inches W.G. 1.99 kPa static pressure; including the additions and modifications specified in this section.

Flexible ductwork is not acceptable.

Provide an explosion relief vent in air-tight ductwork runs to preclude explosive ignition of accumulated unburned fuel vapors.

[2.1.7 Pre-Design Meeting

Prior to commencement of the FAVERS design, the Contractor, and his approved FAVERS design team, shall meet with the Navy at [the ROICC's Office][____] to show the FAVERS User a video of a similar system installed and in use elsewhere. At this meeting the User can discuss design issues that may result from the video showing.

Alternatively, with the agreement of the Contractor and the Contracting Officer, this meeting may be included in the activities of the Partnering session required by the [IFB][RFP] document or held immediately following the Partnering session.

]2.1.8 FAVERS Design Drawings

Provide design drawings; the quality of the design drawings shall be equivalent to that of the Government-originated contract drawings.

a. Plan view of the overall FAVERS layout
b. Exhausted vehicles' locations
c. Actual location and length of guide rails
d. System component locations and mounting details[,including seismic design]
e. Fan locations, duct runs and sizes
f. Structural modifications to the facility to support the FAVERS [,including seismic design]

2.2 FAVERS BASIC COMPONENTS

In addition to the two types of exhaust outlets, horizontal and vertical, there are two types of FAVERS collection means specified: the extensible hose type and the straight rail type. Horizontal exhaust stack systems utilize the sliding balancer track type (SBTTH) and the straight rail type (SRTH). Vertical exhaust stack systems utilize the sliding hose adapter type (SHAV) and the straight rail type (SRTV). These FAVERS type acronyms will be used in the component specifications below when a component applies to only one type of FAVERS.

2.2.1 Guide Track (Rail)

2.2.1.1 Sliding Balancer Track Type - Horizontal (SBTTH)

One piece continuous extruded track in minimum lengths of 20 feet 6.1 meters; aluminum alloy.

2.2.1.2 Sliding Hose Adapter Type - Vertical (SHAV)

One-piece continuous extruded track in minimum lengths of 3.0 meters 10 feet; aluminum alloy.

2.2.1.3 Straight Rail Type - Horizontal (SRTH)

a. One piece continuous extruded track in minimum lengths of 8 feet 2.4 meters, aluminum alloy, bottom of rail equipped with EPDM

rubber sealing lips which extend along the rail continuously from end to end; seals shall be air tight upon negative pressure in the exhausting ductwork but at same time allow balancer trolley to travel easily; heavy gauge polymer plastic cover shall seal ends of rails.

b. Length: Overall length of tracks for drive-through-bays shall extend the length of the bay, to within one foot 300 mm of front and rear doors; overall length of tracks for back-in-bays shall extend from front door to vehicle's rear most exhaust pipe.

c. Hoods: aluminum collection hoods to transition between guide tracks and exhausting ductwork.

2.2.1.4 Straight Rail Type - Vertical (SRTV)

a. One piece continuous extruded track in minimum lengths of 2.4 meters 8 feet, aluminum alloy, bottom of rail equipped with EPDM rubber sealing lips which extend along the rail continuously from end to end; seals shall be air tight upon negative pressure in the exhausting ductwork but at same time allow vertical exhaust stack end to travel easily; heavy gauge polymer plastic cover shall seal ends of rails.

b. Length: Overall length of tracks for drive-through-bays shall extend the length of the bay, to within 300 mm one foot of front and rear doors; overall length of tracks for back-in-bays shall extend from front door to vehicle's rear most exhaust pipe position.

c. Hoods: aluminum collection hoods to transition between guide tracks and exhausting ductwork.

2.2.2 FAVERS Manufacturer's Guide Track Supports and Bracing

a. Factory electro-plated galvanized finish; structural supports' designs shall comply AISC S335.

2.2.3 Balancer Assembly

a. Supports vertical hose and nozzle assembly by adding or releasing tension; suspends vertical hose and nozzle assembly off the floor in a stowed position; open drum for tension cord with spring loaded reverse action and centrifugal brake; tension shall be adjustable.

2.2.4 Trolley Assembly

a. SBTTH: Balancer Trolley - welded and hardened steel plate body, minimum of 6 mm 0.25 inch thick; with minimum of six steel ball bearing trolley suspension wheels.

b. SRTH: Suction Balancer Trolley - Cast aluminum body, minimum of eight nylon trolley suspension wheels; trolley travel may allow an insignificant amount of ambient air into the exhaust system through the rubber seals on the guide tracks, however, exhaust system shall not permit vehicle exhaust to leak out of guide tracks through seals.

c. SHAV: Sliding Hose Adapter - Steel or aluminum adapter body, mounted on minimum of eight trolley wheels, guide rails to engage the vertical stack and to trap the stack within the adapter until fire apparatus leaves the station, and an extensible hose supported by trolley wheels running in the same track as the adapter body.

2.2.5 Trolley Stops

a. SBTT: Stops travel of entire hose and nozzle assembly; stopping action shall be spring, or rubber, or pneumatically cushioned

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NOTE: There are two types of exhaust collecting nozzle systems, aspirating and non-aspirating.

The aspirating systems induce ambient temperature air to flow into the nozzle, which mixes with the exhaust, cools it to protect the hose from high temperatures, and requires the hoses, fans and makeup air systems to handle larger quantities of flow.

The non-aspirating systems do not allow ambient air to mix and cool the exhaust. Their hoses must withstand higher temperatures, but the hoses, exhaust fans, and makeup air units may be smaller, since they do not need to handle the cooling makeup air flow in addition to the combustion air that is required by the engine.

Pneumatic Grabber Nozzles are an example of a non-aspirating type. Electromagnetic nozzles are an example of an aspirating type.

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2.2.6 Horizontal Suction Hose

a. Minimum 100 mm 4.0 inches in diameter for non-aspirating nozzles, or 125 mm 5.0 inches in diameter for aspirating nozzles; at least ten percent longer than the length of the FAVERS track; fabric covered with fire-resistant chloro-sulfonated polyethylene, or approved equivalent.

Provide minimum working temperature rating of171 degrees C 340 degrees F, intermittent temperature rating of 188 degrees C 370 degrees F, for aspirating nozzle systems.

Provide minimum working temperature rating of 204 degrees C 400 degrees F, intermittent temperature rating of 260 degrees C 500 degrees F, for non-aspirating nozzle systems.

Hose helix shall be galvanized steel or aluminum. Hose compression ratio shall be not less than 6 to 1.

b. Hose supports for hose support trolleys: Located on hose every 13 inches 325 mm minimum.

2.2.7 Upper Vertical Suction Hose

a. Minimum 100 mm 4.0 inches in diameter for non-aspirating nozzle types and minimum 125 mm 5.0 inches in diameter for aspirating nozzle types, at least 4.0 meters 13.0 feet in length, same material as the horizontal suction hose.

2.2.8 Lower Vertical Suction Hose

a. Minimum 100 mm 4.0 inches in diameter for non-aspirating nozzle types and minimum 125 mm 5.0 inches in diameter for aspirating nozzle types, at least 1.8 meters 6.0 feet in length, same material as the horizontal suction hose.

2.2.9 Grabber Pneumatic Nozzle - Non-aspirating Type

a. Shall provide a virtually air tight seal around exhaust pipe when connected; seal shall not allow vehicle exhaust gas leakage at exhaust air flows of up to 25.4 meters per second 100 feet per second or at exhaust gas volumes in excess of 230 liters per second 500 cubic feet per minute.

b. Automatic: Automatically adjusts its orifice to capture and seal vehicle exhaust pipes from one inch 25 mm outer diameter to 6 inch 150 mm outer diameter.

c. Nozzle Grab: Nozzle grabbing pressure shall not exceed 15 psi 100 kPa

d. Construction: High temperature synthetic rubber vulcanized to a high temperature synthetic fabric.

e. Pneumatic tubing: Teflon 3 mm 0.125 inches in diameter minimum tubing suitable to exposure to 260 degrees C 500 degrees F exhaust.

f. Air Compressor: Provide an air compressor, ASME-stamped air receiver, filter-dryer, regulator, and pressure gauge to operate the pneumatic nozzle and release system. Compressed air system shall be furnished by the manufacturer of the pneumatic grabber nozzle.

2.2.10 Electromagnet (EMT) Nozzle Assembly - Aspirating Type

a. Extraction Nozzle: Inlet boot shall be EPDM rubber bonded to a heavy gauge steel conical reducer; Internally mounted leaf spring affixed to nozzle to facilitate installation of nozzle on vehicle exhaust pipe.

b. EMT assembly shall keep entire hose assemblies and nozzle (at the vehicle exhaust pipe) attached to the vehicle while in the facility, whether at rest or as it moves to the point of exit from the facility.

c. Assembly includes an electromagnet disc assembly, formed rubber collar protecting EMT assembly, a manual override switch and an anchor plate.

d. Steel sleeve: 6 inch 150 mm minimum galvanized steel; mounting point of electromagnet assembly; junction of upper vertical hose and lower hose

e. Anchor Plate: Outer circular holder, cadmium plated steel disc, minimum of two mounting holes for mounting to vehicle

f. Manual override switch: Mounted externally and easily accessible; for manually de-energizing the electromagnet, allowing the hose and the nozzle assembly to come away unrestrained from the vehicle when in the parked position within the facility; normally closed, single pole, single throw, spring-loaded, momentary ON with a rocking actuator, surrounded and mounted in a closed cell neoprene jacket.

2.2.11 Auto-Disconnect Switch

a. SBTT: Mounted to balancer's bracket; 24 volt microswitch, factory pre-wired to energize and de-energize the electromagnet when it passes the strike plate point.

2.2.12 Exhaust Fans

a. Sized to deliver minimum of 500 CFM 240 liters per second at each hose drop; housing shall be 18 gauge minimum high grade steel with joints continuously welded; impeller of heavy gauge high strength steel; AMCA Class II welded wheel construction; statically and dynamically balanced; constructed and performance rated in accordance with AMCA 211; direct drive motor with maximum vibration displacement of 1.5 mils 0.0038 mm displacement at 3500 RPM.

b. Fan motor: TEFC, 3 phase, continuous duty rated, externally mounted and outside of the air stream.

c. Provide vibration isolating mounts for exhaust fan and motor.

2.2.13 Ductwork

Comply with ACGIH 2092 for an industrial ventilation system of positive and negative pressure of 8 inches W.G. 1.99 kPa static pressure; including the additions and modifications specified in this section.

a. Galvanized steel, round spiral type; branches shall stub into mains at main duct expansion points, in the direction of airflow, at an angle of not more than 30 degrees with the centerline of the main duct.

b. Reducers: Minimum of one inch 25 mm graduating reduction in diameter for each 8 inch 200 mm in length.

c. Elbows: Up to 12 inches 300 mm in diameter shall have a minimum center radius of not less than 1.5 times the elbow diameter; above 12 inches 300 mm in diameter shall have a minimum center radius of not less than 2.5 times the elbow diameter.

d. All fittings: Continuously welded construction; galvanize after welding.

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NOTE: Indicate or specify how and where the

ductwork is to terminate at the exterior of the facility. Exhaust outlet shall terminate at a location and height that will ensure the exhaust air will not re-enter the facility. Outlet shall meet ACIGIH 2092.

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e. Exterior ductwork shall terminate [above the roof line][as indicated][_____] and with a double wall exhaust stack on discharge side of the exhaust fan. Provide piping thimble for stack at roof penetration.

f. Sound Attenuation: Provide exterior type silencer on discharge side of the exhaust fan. FAVERS noise level shall be below 64 dbA at any point inside or outside the facility.

g. Flexible Duct Connectors: Provide a minimum of design pressure rated plus 124 Pa (gage)0.5 inch W.G. static pressure airtight flexible duct connectors at duct connections to each exhaust fan, and ventilating fan. Support connectors at each end with metal angle frame bands, securely bolt in place. Provide not less than 0.60 L 20 ounce glass fabric duct connectors coated on both sides with neoprene.

2.2.14 Electrical Components

Furnish motors, controllers, disconnects and contactors with their respective pieces of equipment. Motors, controllers, disconnects and contactors shall conform to and have electrical connections provided under Section 16402N, "Interior Distribution System", except as specified otherwise in this section.

Furnish internal wiring for components of packaged equipment as an integral part of the equipment. Extended voltage range motors will not be permitted.

Controllers and contactors shall have a maximum of 24 volt control circuits, and shall have auxiliary contacts for use with the controls furnished.

When motors and equipment furnished are larger than sizes indicated, the cost of additional electrical service and related work shall be included under the section that specifies that motor or equipment. Power wiring and conduit for field installed equipment shall be provided under and conform to the requirements of Section 16402N, "Interior Distribution System."

Additionally, electrical components shall meet the following requirements:

a. Fan starter and control console enclosures.

b. Motor starters and all terminals rated for 600 volts.

c. Overload relays shall be an adjustable type with auto/manual reset.

d. Control transformer shall be multi-tap primary and 24 volt secondary.

e. Time relays shall be solid state construction.

2.2.15 Controls

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NOTE: Indicate location of a manual override control in each bay

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Provide individual bay manual control to override the automatic controls, [open the bay exhaust damper,] and start and stop the exhaust fan.

Provide automatic control to start the exhaust fan [prior to] [upon] engine start in any bay served by the fan. ["Prior to engine start" operation may be initiated by radio or electrical signal.] ["Upon engine start" operation may be initiated by electrical or engine exhaust pressure signal.]

Provide timer to maintain exhaust fan operation for an adjustable time period after latest apparatus exit or engine shutdown. Time adjustment shall be not less than zero to 10 minutes.

[Provide individual bay motorized exhaust dampers, opened by engine start in respective bay, and maintained open until time out of timer.]

2.3 INSTRUCTIONS TO GOVERNMENT PERSONNEL

Provide instructions for vehicle exhaust removal systems. Furnish the services of competent instructors from the FAVERS manufacturer to give full instruction to the designated Government personnel in the operation and maintenance of the FAVERS system for two 8 hour work days minimum. Instruction shall be given during a work week selected by the Contracting Officer after the equipment or system has been accepted and turned over to the Government for regular operation. Additional requirements are specified in Section 15050N, "Basic Mechanical Materials and Methods".

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Installation Workmanship

The FAVERS shall be installed by the system manufacturer, or his certified installation organization. Contractor shall submit a manufacturer's letter of installer acceptability from the FAVERS manufacturer endorsing the FAVERS installing organization to be used on this project. Only the FAVERS installing organization approved by the Contracting Officer can install the FAVERS for this contract.

3.1.2 Factory and Field Painting

Factory painting shall comply with the painting requirements specified in Section 15050N, "Basic Mechanical Methods and Materials".

Requirements for field painting are specified in Section 09900N, "Paints and Coatings."

3.2 FIELD QUALITY CONTROL

Upon completion and before final acceptance of work, test each system as specified below to demonstrate compliance with the contract requirements.

3.2.1 Field Testing

3.2.1.1 FAVERS Field Test Plan

Submit equipment field test plan developed by FAVERS manufacturer detailing recommended field test procedures for each item of equipment; submit the plan to the Contracting Officer for review and approval at least 30 calender days prior to commencement of field testing of the equipment. Field test plans developed by the installing Contractor, or the equipment sales agency furnishing the equipment will not be acceptable.

a. Coordinated testing: Indicate in field test plan when work required by this section requires coordination with test work required by other specification sections.

b. Prerequisite work and testing: Identify work/testing on which FAVERS performance testing is dependent.

c. Test procedure: Indicate in field test plan the FAVERS manufacturer's published start-up, and field check-out procedures.

   Include in test plan a detailed step-by-step procedure for testing automatic controls provided by the manufacturer. Test plan shall include the required test reporting forms to be completed by the Contractor's testing representatives.

   Procedures shall be structured to test the controls through all modes of control to confirm that the controls are performing with the intended sequence of control. Controllers shall be verified to be properly calibrated and have the proper set point to provide stable control of their respective equipment.

d. Performance variables: Test plan shall list performance variables that are required to be measured or tested as part of the field test. Include in the listed variables performance requirements indicated on the equipment schedules on the design drawings.

   Manufacturer shall furnish with each test procedure a description of acceptable results that have been verified. Manufacturer shall identify the acceptable limits or tolerances within which each tested performance variable shall acceptably operate.

e. Job specific: Test plan shall be job specific and shall address the particular FAVERS and particular conditions which exist with this contract. Generic or general preprinted test procedures, not edited to be job specific, are not acceptable.

f. Specialized components: Test plan shall include procedures for field testing and field adjusting specialized components, such as vehicle exhaust grabbing device.

3.2.1.2 FAVERS Field Test Report

a. Manufacturer's test: Conduct the manufacturer's recommended field testing in compliance with the approved test plan specified above. Furnish a factory trained field representative authorized by, and to represent, the equipment manufacturer at the complete execution of the field testing.

b. Operational test: Conduct a minimum continuous 2 hour operational

test for each item of equipment. Equipment shutdown before the test period is completed shall result in the test period being started again and run for the required duration.

For the duration of the test period, compile an operational log of each item of equipment. Use the test report forms for logging the operational variables every 15 minutes.

c. Notice of tests: Notify the Contracting Officer in writing at least 15 calendar days prior to the testing.

d. Report forms: Type data entries and writing on the test report forms. Within 30 calendar days after acceptable completion of testing, submit field test report for review and approval. Completed test report forms for each item of equipment shall be reviewed, approved, and signed by the Contractor's test director and the QC manager. The manufacturer's field test representative shall review, approve, and sign the report of the manufacturer's recommended test. Signatures shall be accompanied by the person's name typed.

3.2.2 Deficiency Resolution

Deficiencies identified during the tests shall be corrected in compliance with the manufacturer's recommendations. All FAVERS work that is affected by each deficiency correction shall be acceptably tested again in accordance with the approved test plan after the corrective work is complete.

-- End of Section --